



**AO4709**  
**P-Channel Enhancement Mode Field Effect Transistor**  
**with Schottky Diode**

**General Description**

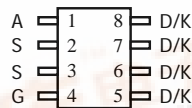
The AO4709 uses advanced trench technology to provide excellent  $R_{DS(ON)}$  and low gate charge. A Schottky diode is provided to facilitate the implementation of non-synchronous DC-DC converters. *Standard Product AO4709 is Pb-free (meets ROHS & Sony 259 specifications). AO4709L is a Green Product ordering option. AO4709 and AO4709L are electrically identical.*

**Features**

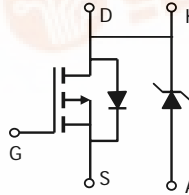
$V_{DS} (V) = -30V$   
 $I_D = -8A (V_{GS} = -10V)$   
 $R_{DS(ON)} < 33m\Omega (V_{GS} = -10V)$   
 $R_{DS(ON)} < 56m\Omega (V_{GS} = -4.5V)$

**SCHOTTKY**

$V_{DS} (V) = 30V, I_F = 3A, V_F < 0.5V @ 1A$



SOIC-8



**Absolute Maximum Ratings  $T_A=25^\circ C$  unless otherwise noted**

Parameter	Symbol	MOSFET	Schottky	Units
Drain-Source Voltage	$V_{DS}$	-30		V
Gate-Source Voltage	$V_{GS}$	$\pm 20$		V
Continuous Drain Current <sup>A</sup>	$I_D$	$T_A=25^\circ C$	-8	A
		$T_A=70^\circ C$	-6.6	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	-40		
Schottky reverse voltage	$V_{KA}$		30	V
Continuous Forward Current <sup>A</sup>	$I_F$	$T_A=25^\circ C$	4.4	A
		$T_A=70^\circ C$	3.2	
Pulsed Forward Current <sup>B</sup>	$I_{FM}$		30	
Power Dissipation	$P_D$	$T_A=25^\circ C$	3	W
		$T_A=70^\circ C$	2	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	-55 to 150	$^\circ C$

Parameter: Thermal Characteristics MOSFET		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup>	$t \leq 10s$	$R_{\theta JA}$	24	40	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>	Steady-State		54	75	
Maximum Junction-to-Lead <sup>C</sup>	Steady-State	$R_{\theta JL}$	21	30	
Thermal Characteristics Schottky					
Maximum Junction-to-Ambient <sup>A</sup>	$t \leq 10s$	$R_{\theta JA}$	36	40	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>	Steady-State		67	75	
Maximum Junction-to-Lead <sup>C</sup>	Steady-State	$R_{\theta JL}$	25	30	



Electrical Characteristics ( $T_J=25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$I_D=-250\mu\text{A}$ , $V_{GS}=0\text{V}$	-30			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=-24\text{V}$ , $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			-1 -5	$\mu\text{A}$
$I_{GSS}$	Gate-Body leakage current	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 20\text{V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$ , $I_D=-250\mu\text{A}$	-1.2	-2	-2.4	V
$I_{D(ON)}$	On state drain current	$V_{GS}=-10\text{V}$ , $V_{DS}=-5\text{V}$	40			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=-10\text{V}$ , $I_D=-8\text{A}$ $T_J=125^\circ\text{C}$		24.5 33	33	m $\Omega$
		$V_{GS}=-4.5\text{V}$ , $I_D=-5\text{A}$		41	56	m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS}=-5\text{V}$ , $I_D=-8\text{A}$		14.5		S
$V_{SD}$	Diode Forward Voltage	$I_S=-1\text{A}$ , $V_{GS}=0\text{V}$		-0.76	-1	V
$I_S$	Maximum Body-Diode Continuous Current				-4.2	A
<b>DYNAMIC PARAMETERS</b>						
$C_{iss}$	Input Capacitance	$V_{GS}=0\text{V}$ , $V_{DS}=-15\text{V}$ , $f=1\text{MHz}$		920		pF
$C_{oss}$	Output Capacitance			190		pF
$C_{rss}$	Reverse Transfer Capacitance			122		pF
$R_g$	Gate resistance	$V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$		3.6		$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g(10\text{V})$	Total Gate Charge (10V)	$V_{GS}=-10\text{V}$ , $V_{DS}=-15\text{V}$ , $I_D=-8\text{A}$		18.4		nC
$Q_g(4.5\text{V})$	Total Gate Charge (4.5V)			9.3		nC
$Q_{gs}$	Gate Source Charge			2.7		nC
$Q_{gd}$	Gate Drain Charge			4.9		nC
$t_{D(on)}$	Turn-On DelayTime	$V_{GS}=-10\text{V}$ , $V_{DS}=-15\text{V}$ , $R_L=1.8\Omega$ , $R_{GEN}=3\Omega$		7.1		ns
$t_r$	Turn-On Rise Time			3.4		ns
$t_{D(off)}$	Turn-Off DelayTime			18.9		ns
$t_f$	Turn-Off Fall Time			8.4		ns
$t_{rr}$	Body Diode Reverse Recovery Time		$I_F=-8\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$		21.5	
$Q_{rr}$	Body Diode Reverse Recovery Charge	$I_F=-8\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$		12.5		nC
<b>SCHOTTKY PARAMETERS</b>						
$V_F$	Forward Voltage Drop	$I_F=1.0\text{A}$		0.45	0.5	V
$I_{rm}$	Maximum reverse leakage current	$V_R=30\text{V}$ $V_R=30\text{V}$ , $T_J=125^\circ\text{C}$ $V_R=30\text{V}$ , $T_J=150^\circ\text{C}$		0.007 3.2 12	0.05 10 20	mA
$C_T$	Junction Capacitance	$V_R=15\text{V}$		37		pF

A: The value of  $R_{\theta JA}$  is measured with the device mounted on  $1\text{in}^2$  FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The value in any given application depends on the user's specific board design. The current rating is based on the  $t \leq 10\text{s}$  thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

C: The  $R_{\theta JA}$  is the sum of the thermal impedance from junction to lead  $R_{\theta JL}$  and lead to ambient.

D: The static characteristics in Figures 1 to 6,12,14 are obtained using  $80\mu\text{s}$  pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on  $1\text{in}^2$  FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The SOA curve provides a single pulse rating. Rev 4: Sept 2005

THIS PRODUCT HAS BEEN DESIGNED AND QUALIFIED FOR THE CONSUMER MARKET. APPLICATIONS OR USES AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS ARE NOT AUTHORIZED. AOS DOES NOT ASSUME ANY LIABILITY ARISING OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO IMPROVE PRODUCT DESIGN, FUNCTIONS AND RELIABILITY WITHOUT NOTICE

**P-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

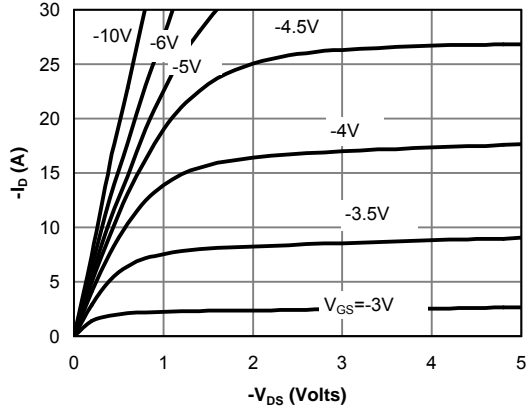


Fig 1: On-Region Characteristics

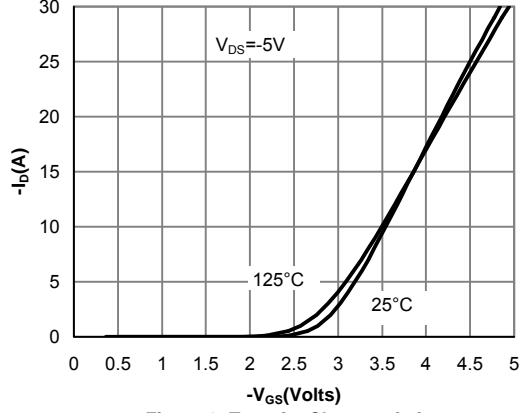


Figure 2: Transfer Characteristics

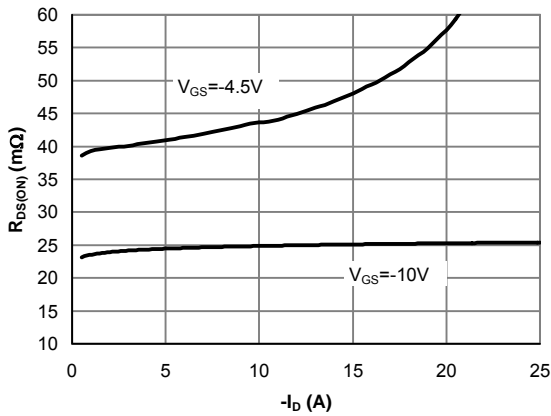


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

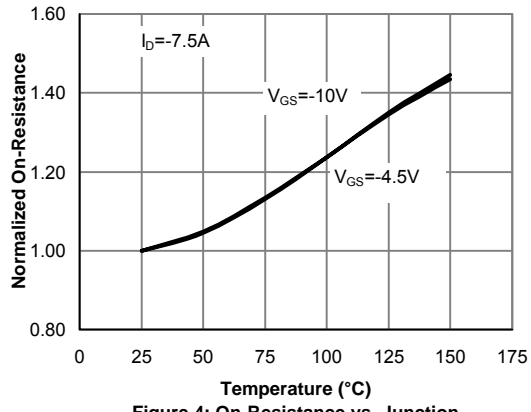


Figure 4: On-Resistance vs. Junction Temperature

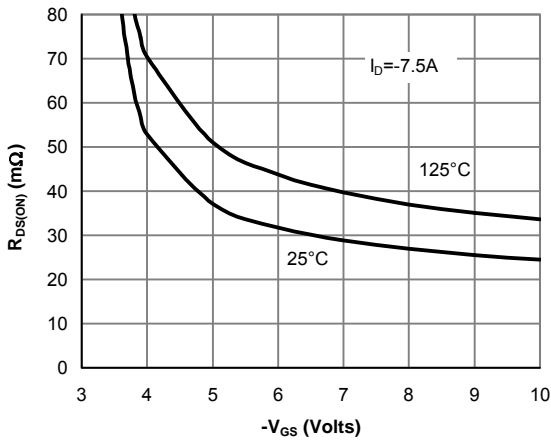


Figure 5: On-Resistance vs. Gate-Source Voltage

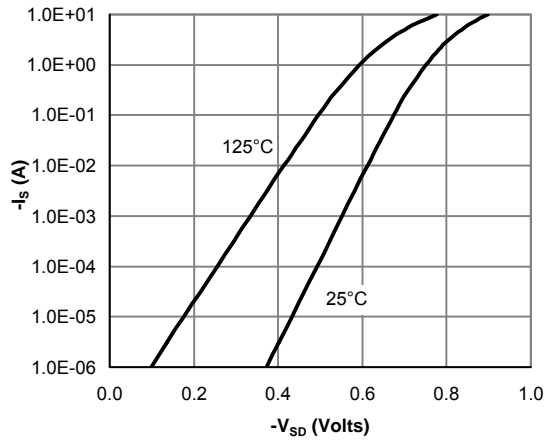


Figure 6: Body-Diode Characteristics

P-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

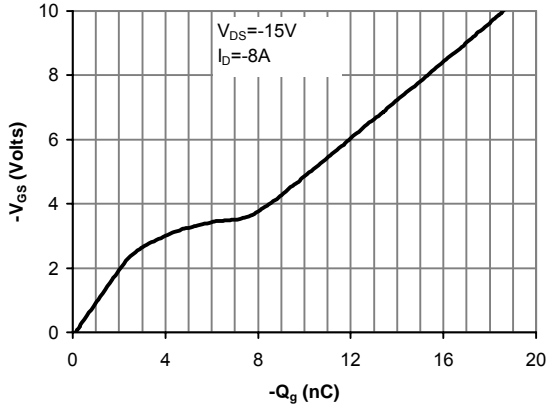


Figure 7: Gate-Charge Characteristics

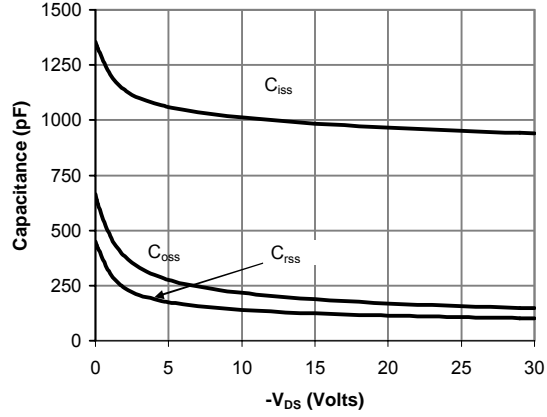


Figure 8: Capacitance Characteristics

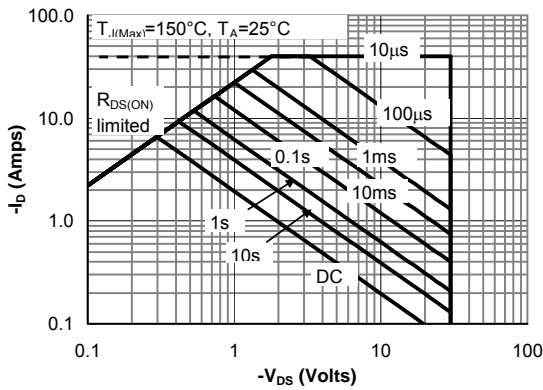


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

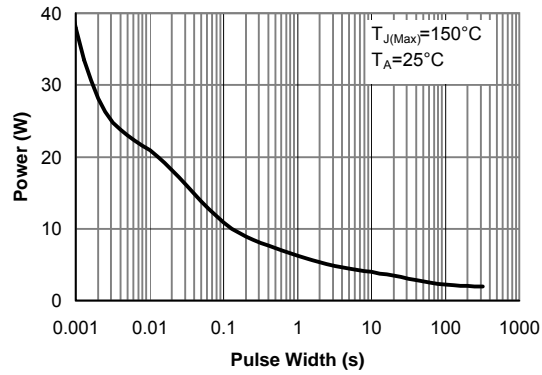


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

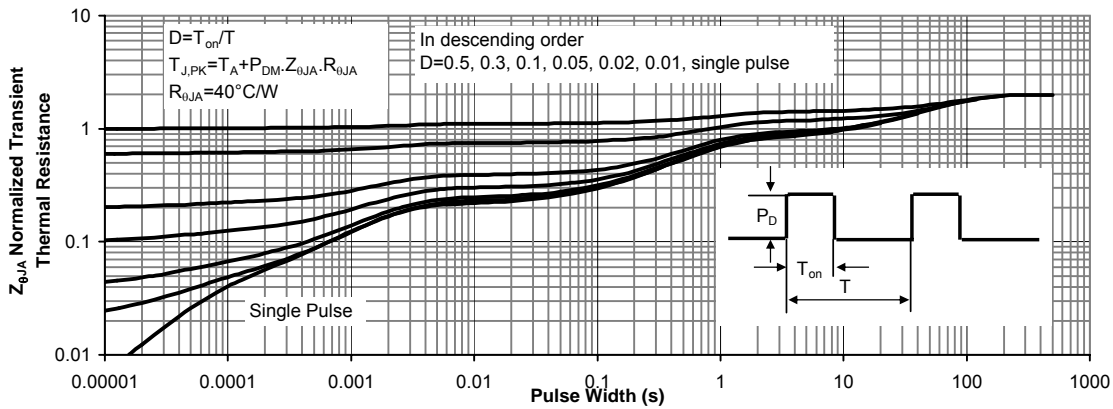


Figure 11: Normalized Maximum Transient Thermal Impedance

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: SCHOTTKY

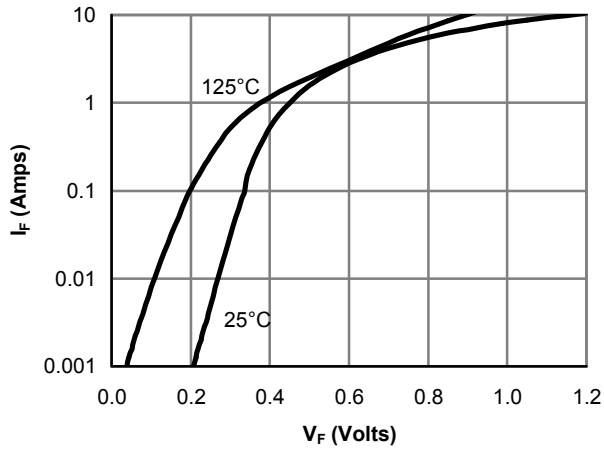


Figure 12: Schottky Forward Characteristics

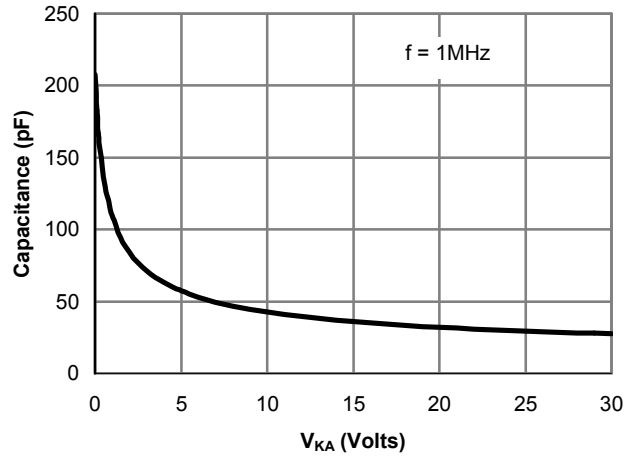


Figure 13: Schottky Capacitance Characteristics

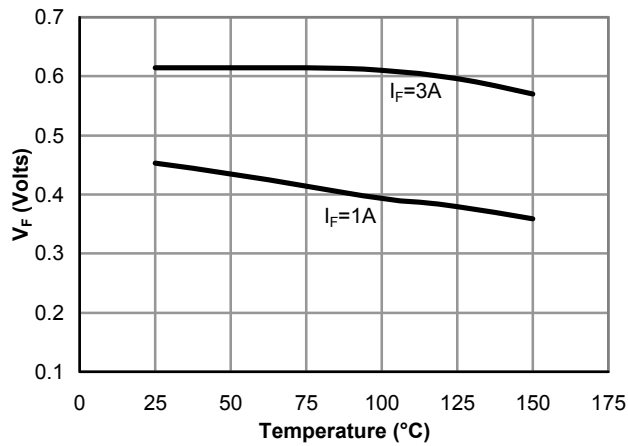


Figure 14: Schottky Forward Drop vs. Junction Temperature

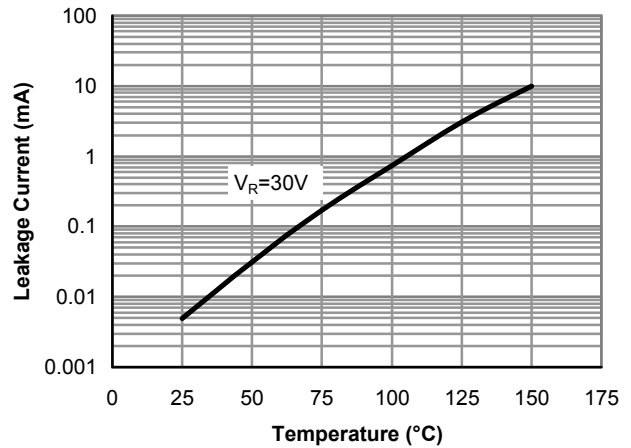


Figure 15: Schottky Leakage current vs. Junction Temperature

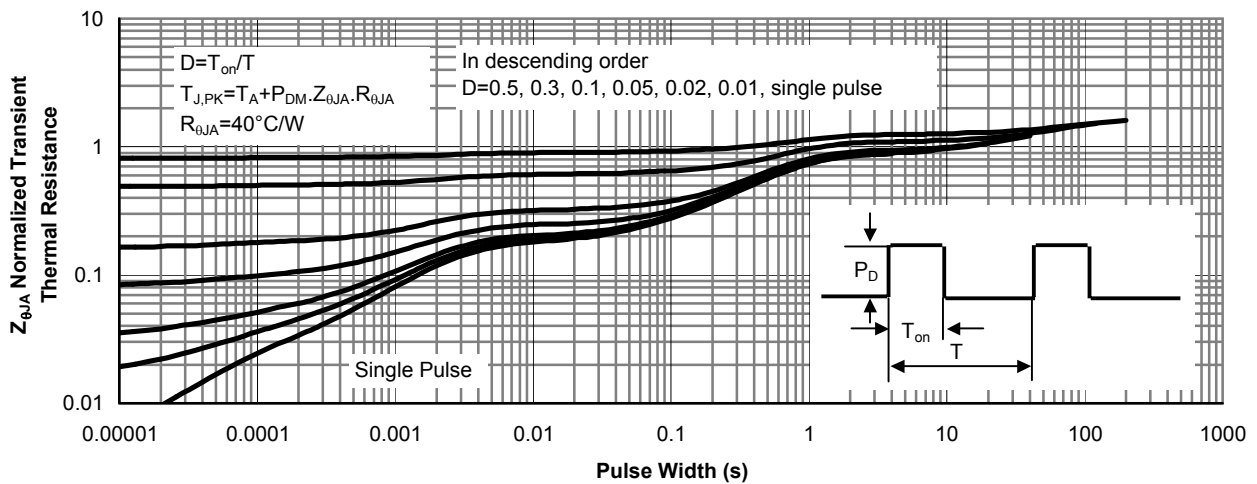


Figure 15: Schottky Normalized Maximum Transient Thermal Impedance